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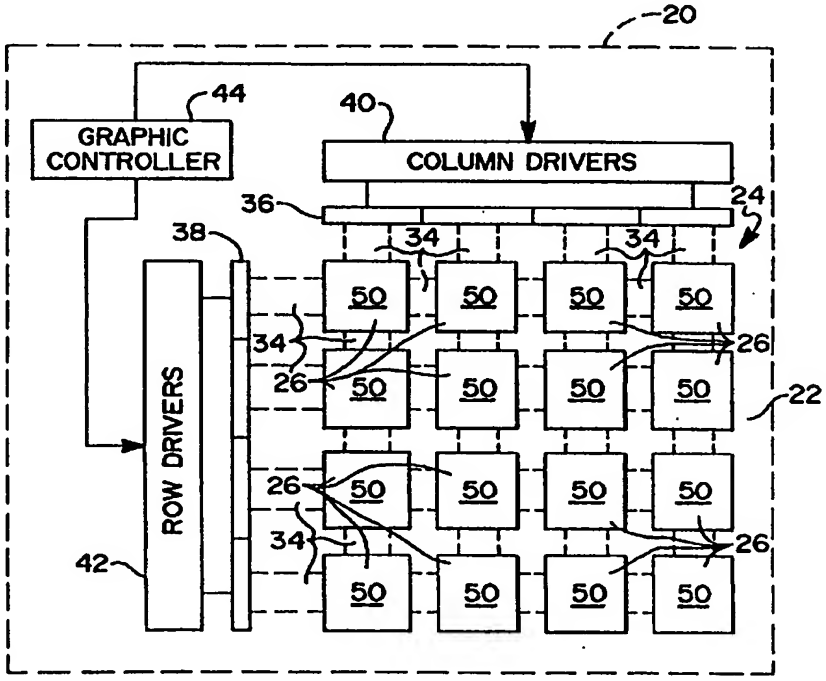
(54) Title: INTERACTIVE KEYSET

(57) Abstract

An interactive keyset (22) is provided for original or replacement installation on a set of keyboard switches (28) which control an electronic device (20). Each key (26) comprises a base (32) which mounts a cap (84) having a window (88), an LCD or other display (50) and a backlight (94). Flat flexible plastic wiring strips (54, 64, 74, 78) carry conductors (56) for interconnecting all keys (26) in the keyset (22) with a controller (44). The wiring strips have mounting holes (60) which cooperate with mounting pins (100) on the keys to mechanically connect the strips with the keys. Each key (26) carries a device (110) for assuring electrical contact between contacts (58) on the wiring strips and mating contacts (108) on the displays (50). Manipulation of the keys (28) produces sequential sets of coordinated displays (Figs 12a-e) of key functions.



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INTERACTIVE KEYSET

BACKGROUND OF THE INVENTION

This invention relates generally to man/machine interfaces for devices that are controlled by key-operated switches mounted on a keyboard and, more particularly, to an interactive, programmable keyset for the keyset for the switches that controls such devices.

Presently-available keyboards for such devices comprise a set of keys mounting a keyset of keys having superficial keytop indicia which denote the key functions. Examples of these controlled devices include computers, industrial controls, and consumer electronics, such as programmable calculators, telephones, fax machines and copiers. It is often difficult to display all possible functions of the keys of these devices to the user.

For example, in computers, the common function keys enable the standard keys to have a plurality of functions, but do not provide information on these actual functions. Current arrangements for indicating functions include inscribing multiple characters on the tops or sides of keys, on the adjacent keyboard surface, on an auxiliary legend above or beside the keyboard, on removable overlays for the keyboard, or on a legend on the computer monitor screen.

In most instances, these indicia are inadequate. They either require user interpretation or do not enable the indicia to change as frequently and quickly as their functions change. One example of this inadequacy is that the thousands of Japanese language characters cannot all be exhibited at once or conveniently. Current arrangements are unsuitable, because they require multiple shift

configurations or tedious correction of typed characters with a mouse.

As computers have been downsized for portability, from transportable, to portable, to laptop, to notebook, to subnotebook sizes, available keyboard space to display multiple functions has decreased dramatically. At the same time, increased software complexity has increased the numbers of functions these keys must perform.

Computer input devices, such as a mouse or trackball or digitizer, compel the user to take his hands off the keyboard, which slows user performance. When integrated within the keyboard as in current laptops, the pointer is often insufficiently legible on the screen. In CAD, the digitizer tablet compels the user to repeatedly shift between screen and tablet to locate the screen pointer onto small icons.

Other interfaces using screen menus subtract from usable screen space. Touch screens are difficult to use properly, because the "touch buttons" are too small, causing mistakes, or too large, limiting the number of displayable functions.

Industrial control panels often consist of a series of function keys placed beneath a monitor screen which displays the keys' functions. This limits the number of function keys to the one row displayed. Also, because of parallax, the display is only functionally usable if the operator stands in front of the screen.

In telephones and fax machines, the number of programmed so-called "speed dial" numbers and other functions far exceeds the space available to display these functions. The same is true for calculators and copiers.

The problem is exacerbated by the simultaneous increase in functions and decrease in physical size.

Single multifunctional pushbutton switches having an LCD display on or adjacent their operating keys have been developed. Each of these switches ("intelligent switches") incorporates its own driver with the mechanical switch and is individually programmable. As such, these switches are bulky and expensive, thus limiting their use to industrial applications. They also must be integrated into the controlled devices control circuitry.

There is a need for a keyset for a controlled device which employs keys that have function displays and are interconnected with a controller that can easily and quickly change the displayed functions for all keys among sets of coordinated displays of predetermined functions, as if they were all segments of a single screen.

There is a need for a keyset of this type which comprises a set of keys interconnected by flexible wiring and can be simply and easily adapted to any existing keyboard with minor modification.

There is a need for a keyset of this type that has keys that can display any desired type of function information including moving and still icons, images, alphanumeric characters, or any language or other symbol or graphics information.

There is a need for a keyset of this type that is easily and inexpensively manufactured, is adaptable to any controlled device having a keyboard comprising multifunction control keys, and is much simpler and less expansive than sets of the "intelligent switch" keys.

SUMMARY OF THE INVENTION

It is therefore an object of this invention to provide a keyset for a controlled device which employs keys that have function displays and are interconnected with a controller that can easily and quickly change the displayed functions for all keys among sets of coordinated displays of predetermined functions, as if they were all segments of a single screen.

Another object of this invention is to provide a keyset of this type which comprises a set of keys interconnected by flexible wiring and can be simply and easily adapted to any existing keyboard with minor modification.

Yet another object of this invention is to provide a keyset of this type that has keys that can display any desired type of function information including moving and still icons, images, alphanumeric characters, or any language or other symbol or graphics information.

A yet further object of this invention is to provide means responsive to keyset manipulation to change the keyset displays from one set of coordinated displays to another such set.

A yet further object of this invention is to provide a keyset of this type that is easily and inexpensively manufactured, is adaptable to any controlled device having a keyset comprising multifunction control keys, and is much simpler and less expansive than sets of the "intelligent switch" keys.

In one aspect, this invention features a keyset that inputs function commands to a controlled device via a plurality of input switches, characterized by an

interactive keyset comprising a plurality of manually-actuatable keys each operating one of the switches. A display carried by each key displays information identifying a function associated with key operation and a controller selectively controls the displays of all keys as a unit to provide sets of coordinated displays of predetermined functions. Flexible wiring means connects each key display with the controller.

The display may be LCD, electrochromic or other and is preferably backlit.

In another aspect, this invention features flexible wiring means which include a plurality of flat plastic strips each carrying a plurality of electrical conductors terminating in a plurality of contacts which are interengaged with mating contacts on each display .

In yet another aspect, this invention features an interactive keyset which is a replacement for a normal keyset in which the manually-actuatable keys each include a base having attachment means for operatively attaching the key to a switch actuator and means mounting the display.

In still another aspect, this invention features a keyset for a set of input switches that are arranged in a plurality of rows and columns and the flexible wiring means comprises a web of flexible plastic which mounts a plurality of electrical conductors interconnecting each key display with the controller.

In a further aspect, this invention features flexible wiring means which include means electrically interconnecting the displays and mechanically interconnecting the keys.

These and further objects and features of this invention will become more readily apparent upon reference to the following detailed description of a preferred embodiment, as illustrated in the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic diagram of a keyboard having a keyset for operating a keyboard for a controlled device in which each key has a display controlled by a controller according to this invention;

Figs. 2a and 2b are side and plan views of one embodiment of flexible wiring means for interconnecting keys of the keyboard of Fig. 1;

Fig. 3 is a plan view of another embodiment of flexible wiring means comprising a web of flat flexible plastic mounting electrical conductors which interconnect all key displays with the controller;

Fig. 4a is another embodiment of flexible wiring means for interconnecting a row of four keys;

Fig. 4b is yet another embodiment of flexible wiring means interconnecting four rows of four keys;

Figs. 5a, 5b, 5c, and 5d are schematic representations of different wiring connections for the keys of the keyset of Fig. 1;

Fig. 6 is an enlarged exploded view of one of the keys of the keyset of Fig.1;

Fig. 7 is a plan view of the key of Fig. 6;

Fig. 8 is a sectional view which is taken along line 8 - 8 of Fig. 7;

Fig. 9 is a sectional view which is taken along line 9 - 9 of Fig. 7;

Fig. 10 is perspective view of a connector for connecting the flexible wiring means contacts with mating contacts on a display;

Fig. 11 is a lateral sectional view of a replacement keyset according to this invention; and

Figs. 12a, 12b, 12c and 12d are schematic views of a sequential progression of keyset displays for one embodiment of this invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to Fig. 1, a microprocessor-controlled device 20, such as a telephone, includes a keyboard 22 which mounts a keyset 24 comprising a plurality of keys 26. As shown in Fig. 11, keys 26 are mounted on and operate a plurality of keyboard switches 28 which control operation of device 20. Each switch has a top actuator 30 which mounts a key base 32 for reciprocal operation of the switches by the keys in a well-known manner.

Keys 26 are arranged in four rows and four columns and are physically and electrically interconnected by flat flexible wiring means 34. The column and row ends of the wiring means mount electrical connectors 36 and 38 which attach to column and row drivers 40 and 42. The column and row drivers 40 and 42 are controlled by a graphic controller 44. Drivers 40 and 42 may be integrated with

graphic controller 44 and all with the device's internal electronics into a single controller unit.

Each key 26 mounts a graphic display unit 50 which may be an LCD, LED or electrochromic display for displaying alphanumeric or other images or graphics information. Key displays 50 are electronically integrated by wiring means 34 and controlled by controller 44 to provide sets of coordinated displays of predetermined functions, as will be later discussed. Controller 44 is controlled by the device 20's microprocessor which has a memory storing the graphics and other symbols displayed by the displays 50 in coordinated sets.

One form of flexible wiring means comprises a plurality of preferably identical wiring strips 52 shown in Figs. 2a and 2b. Each strip 52 includes a flexible flat plastic base 54 which mounts a plurality of spaced preferably printed conductors 56 which are covered by an insulating layer 57 and terminate in exposed contacts 58. The end of each flexible wiring strip 52 includes a pair of spaced mounting holes 60. Each flexible wiring strip 52 interconnects two keys in a row or column or connects an end key to one of the drivers 40, 42, as will be later described.

Another form of wiring means 34 is illustrated in Fig. 3 as comprising a unitary apertured sheet or web 62 which is a latticework of flexible plastic having four spaced row strips 64 mounting the spaced printed conductors 56 and four spaced column strips 66 mounting conductors 56. Strips 62 and 64 have raised areas 68 at their intersections for receiving displays 50. Web 62 essentially integrates all of strips 52 into a unitary whole. As with strips 52, web 62 includes pairs of spaced mounting holes 60 adjacent raised areas 68. Web 62

incorporates integral column and row connector portions having exposed contacts 70 and 72 and contacts 58.

Fig. 4a illustrates a single flexible carrier ribbon or strip 74 which mounts four branch strips 75 which each contain exposed contacts 58 and a pair of mounting holes 60. Strip 74 has an end connector having exposed contacts 76 for connection to one of the drivers 40, 42. Strip 74 performs the function of four strips 52 to interconnect four displays 50 and to connect the end display to a driver.

Fig. 4b shows a multi-strip 78 which has four parallel and spaced ribbons or strips 79, which combine the function of four strips 74, but includes exposed connector contacts 58 and mounting holes 60 in a continuous strip for connection to 16 displays 50. It includes an end connector having exposed contacts 80 for connection to one of the drivers 40, 42.

Figs. 5a, 5b, 5c and 5d illustrate various ways of electrically and mechanically interconnecting the displays 50. In Fig. 5a, displays 50 are connected in series by individual connector strips 52. In Fig. 5b, the series connection of displays 50 is accomplished by the use of strip 74 or multi-strip 78 or web 62. In Fig. 5c, displays are connected by branch strips 81 to a carrier strip 83. Fig. 5d illustrates yet another embodiment where each display 50 is carries a prewired strip 82, like strip 52, for connection directly to a controller or other intermediate connector of other wiring, not shown.

Keys 26 are preferably made,of injection molded plastic parts. The construction of one of the keys 26 is shown in detail in Figs. 6 - 9. A open-bottom key cap or cover 84 has a top opening 86 that mounts a transparent window 88 which is assembled from above. Display 50 is

received through bottom opening 90 followed by an insert 92, which receives a backlight unit 94 having a locating pin 96. Base 32 includes a platform 98 that mounts four mounting pins 100 for receiving the mounting slots 60 on any of the flexible wiring strips,such as strip 52. Base platform 98 carries a locating slot 102 for receiving the backlight electrical contact pin 96, and protruding lock tabs 104 which snap into mating slots 106 on cover 84 when assembled.

As shown best in exaggerated form in Fig. 10, display 50 carries a plurality of electrical contacts 108 which are electrically interengaged with the mating contacts 58 of flexible wiring conductors 56 by an elastomeric a conductor strip 110, sometimes known as a "zebra strip", which comprises alternating layers of conductive and isolating nonconductive of silicone rubber. Zebra strip 110 is compressed between cover 84, insert 92 and platform 98 to assure good contact with both contacts 58 and mating contacts 108.

Assembly of the keys will now be described in an exemplary keyset incorporating flexible wiring web 62. To assemble the key, window 88 is glued into opening 86 of cover 84. Display 50 is then inserted through opening 90, followed by insert 92, zebra strip 110 and backlight 94. The remaining keys are then similarly assembled. Then a key is positioned over and assembled at each raised portions 68, with mounting pins 100 inserted into mounting holes 60. Each key's base platform 98 is then snapped into a cover 84, compressing zebra strips 110 to assure good electrical contact between display 50 and wiring strip 79. The assembled keyset of keys 26 is now ready for installation. It can be handled as a unit since it is maintained as a unit mechanically by the web of flexible plastic and the connections 60, 100. The keys 26 are all

electrically interconnected to the row and column connector contacts 72 and 70.

One installation of a set of keys 26 as a replacement or original keyset is shown in Fig. 11. One row of switches 28 which control telephone 20 in Fig. 1, are shown mounted on a printed circuit board 22. The keys 26 of the keyset 24 are positioned above switches 26. Each key base 32 includes a central cavity 112 which is adapted to receive a switch actuator 30. The keys are then pushed onto the switch actuators 30 and wiring connector 80 is attached to the connector 38 of row driver 42, which is mounted on a controller printed circuit board 114. To complete the keyset, the other three rows of keys are similarly mounted, and all are similarly connected to connector 36 of column driver 40. The installed keyset 22 is now ready for operation.

Figs. 12a - 12e illustrate operation of this invention in which the four rows of four keys in telephone keyset 22 are represented schematically. Its initial coordinated display includes the normal basic telephone keyset of the 1 - 9 and 0 keys, plus * and # keys. Additional function keys provide "REDIAL" and "VOLUME" (handset) keys, plus "NUMBER" and "FEATURES" keys. The keys can be manipulated in the usual fashion to dial a known telephone number to reach a call destination. However, with this invention, further coordinated sets of sequential displays are available to greatly expand the utility of the telephone keyset.

Depressing only one of the keys causes the microprocessor controlling controller 44 or other means to change the keyset displays from one set of coordinated displays to another such set. For example, depressing the "NUMBER" key causes the Fig. 12b display to appear, giving a directory or menu of a variety of different types of

telephone call destinations. By depressing the "CITY GOV" (city government) key, the display shown in Fig. 12c appears. As illustrated, some of the keys have graphic symbols to designate the call destination, such as the ambulance and fire truck icons. Telephone numbers of the illustrated call destinations have been previously programmed in, enabling the telephone user to merely depress one key for instant "speed dialing". Thus, depressing the "firetruck" key will dial the city fire department.

In this manner any of the 16 displayed call destinations can be reached by merely depressing the appropriate key. Speed dialing in present telephones is limited to 10 or 20 call destinations listed on a card or in a directory which are dialed by manipulating three keys. With this invention, a virtually limitless number of call destinations can be made immediately available for one key dialing. All sub directories provides a number of call destinations equal to a multiple of the number of keys. A three-deep display can provide 4096 different call destinations, all reachable by merely operating one key.

Similarly, by depressing the "CLIENTS" key, the Fig. 12d geographical display appears. This display includes flag icons to designate Israel, U.S.A., Canada and Japan. Other keys carry the international 2-letter country designations. By depressing the key displaying the Israeli flag, a directory (not illustrated) of call destinations in Israel would appear. Also, by depressing the "FEATURES" key, the Fig. 12e display will instantaneously appear.

Any number of levels of subdirectories are possible, limited only by the memory capacity of the controller. Any display may contain from 1 to 16 call destinations. Each display need only display, in coordinated sets, the information needed by the user at that time. This

eliminates the need to memorize or look up hundreds of telephone numbers. Hand-written personal directories are no longer needed. Once programmed in, these numbers are instantaneously available via keyset manipulation which provides coordinated sets of displays of their call destinations. Return to a higher-level display can be accomplished in many ways. The simplest would be to provide a key displaying "RETURN", as in Fig. 12, or to simultaneously actuate two keys.

Of course, this invention is not limited to use on the telephone keyset described above. By applying this invention to computers, the user interface becomes an intuitively "friendly" man-machine interface. By careful menu/directory programming, an entire instruction manual could be available on the computer. Currently available "help" arrangements are slow and limited, since they are accessed by operation of a single "help" key. Using the interactive keyset of this invention provides a 100-key menu to access the computer help files. By entering subdirectories via the enormous number of menu entries available on the interactive keyset of this invention, any part the entire instruction manual can be instantaneously accessed for display on the monitor. Since the keyset is interactive, it can display information on the status of the controlled device, such as malfunctions, either automatically or in response to a trouble-shooting routine.

Other uses of this invention are control keysets for calculators, copiers, fax machines, industrial machines power generation equipment, and other multifunctional communications hybrid applications. Useful typewriters and computers having complex language capabilities (e.g. Japanese, Chinese, Arabic) are now possible. In addition, this enables retrofitting existing computer and microprocessor-controlled devices with interactive keysets to improve their versatility and utility.

This invention provides several significant advances over the present state of the art. It is extremely inexpensive since each key is a "dumb" key that contains no electronics (as do the "smart switches"). The illustrated embodiment includes only a plastic body, a display, a backlight and an electrical connector ("zebra") strip.

A keyset of these "dumb" keys are interconnected with a single centralized, commercially-available controller that commands all keys to provide sets of coordinated displays of predetermined functions. The keys are all driven together as if they were individual parts of a single display. This enables the display of alphanumeric and other graphic symbols of any type, including icons and Japanese and Chinese characters in coordinated sets.

The graphic controller is connected to the controlled device 20's internal electronics including a microprocessor and memory by hardwire or wirelessly remotely. The components may be built on a printed circuit board or card and may additionally contain an interface unit, driver, CPU, memory (RAM, ROM, EEPROM, FLASH, etc.) video, graphics controller, coder/decoders, keyboard electronics, IR system and similar instruments to control and address the displays, program the keys, unload/store programs and key images, for remote control, to activate the controlled device, and the like.

The displays are all interconnected electronically and mechanically by flexible wiring means in the form of thin strips, sheets or webs of flexible plastic bearing printed circuits or other flexible conductors. This structural interconnection is one factor which enables the keyset to readily replace existing keysets on keyboards of existing electronic devices. It enables an entire keyset to be installed as a unit. Changing key spacing to accommodate different switch spacing is easily accomplished by changing

the lengths of the flexible wiring means. It also enables inexpensive and simple customization to accommodate any existing size and spacing of keys on any existing keyboard. This gives new and expanded life to numerous existing designs of electronic devices.

The wiring for rows of keys can be the same as, or different from, the wiring for the columns of keys.

The conductors can be formed by printing and, if necessary, electroplating on the flexible plastic carrier strips. Some of the strips could additionally carry other circuit components. It may also be possible to mount the displays directly or to physically integrate the displays on the keycaps, or on the flexible plastic strips, along with the wiring.

In addition, any type of display, such as LCD (active or passive matrix), LED, electrochromic thin film technique for ink-on-paper appearance, electroluminescent, ferroelectri or plasma, can be used with or without backlighting (reflective, transmissive or transflective display) or with sidelighting. Also, this invention can be adapted to any type of switch, such as zero-travel, silicone rubber type, tactile sensation type, full travel or other.

While only preferred embodiments have been illustrated and described, obvious modifications thereof are contemplated within the scope of this invention and the following claims.

We claim:

1. An interactive keyset that inputs function commands to a controlled device via a plurality of input switches, characterized by comprising

a plurality of manually-actuatable keys each operating one of the switches,

a display carried by each key for displaying information identifying a function associated with key operation,

a controller for selectively controlling the displays of all keys as a unit to provide sequential sets of coordinated displays of predetermined functions,

flexible wiring means connecting each key display with the controller, and

means responsive to keyset manipulation to change the keyset displays from one set of coordinated displays to another such set.

2. The interactive keyset of claim 1, further characterized by the display including means for displaying alphanumeric and other symbols.

3. The interactive keyset of claim 1, further characterized by the display being an LCD.

4. The interactive keyset of claim 1, further characterized by the display being an electrochromic display.

5. The interactive keyset of claim 1, further characterized by the flexible wiring means including a plurality of flat flexible plastic strips each carrying a plurality of electrical conductors in the form of printed circuits terminating in a plurality of contacts, and each display including a plurality of mating contacts, and

including means for interengaging the contacts with the mating contacts.

6. The interactive keyset of claim 5, further characterized by each flat plastic strip including electrical conductors and contacts for electrical connection to at least two displays.

7. The interactive keyset of claim 6, further characterized by the wiring means and keys including means mechanically interconnecting the flat plastic strips to the keys.

8. The interactive keyset of claim 1, further characterized by the flexible wiring means comprising a web of flat flexible plastic mounting electrical conductors which interconnect all key displays with the controller.

9. The interactive keyset of claim 1, further characterized by each key comprising a base attached to a switch and mounting a display, backlighting means carried by the base beneath the display for backlighting the display, and a transparent window mounted on the base over the display.

10. The interactive keyset of claim 9, further characterized by the flexible wiring means including means mechanically interconnecting the keys.

11. The interactive keyset of Claim 1, wherein the input switches each have an actuator and a removable normal keyset having a plurality of keys each operatively mounted on an actuator, and the interactive keyset is a replacement for the normal keyset, further characterized by the manually-actuatable keys each including a base having attachment means for operatively attaching the key to a switch actuator and means mounting the display, and the

flexible wiring means comprising a web of flat flexible plastic mounting electrical conductors which interconnect all key displays with the controller.

12. The interactive keyset of claim 1, wherein the input switches are arranged in a plurality of rows and columns, further characterized by the flexible wiring means comprising a web of flexible plastic which has a plurality of portions for receiving the keys and which mounts a plurality of electrical conductors interconnecting each key display with the controller.

13. The interactive keyset of claim 12, further characterized by each display including a plurality of contacts and the wiring means including mating contacts for engaging the contacts of all keys.

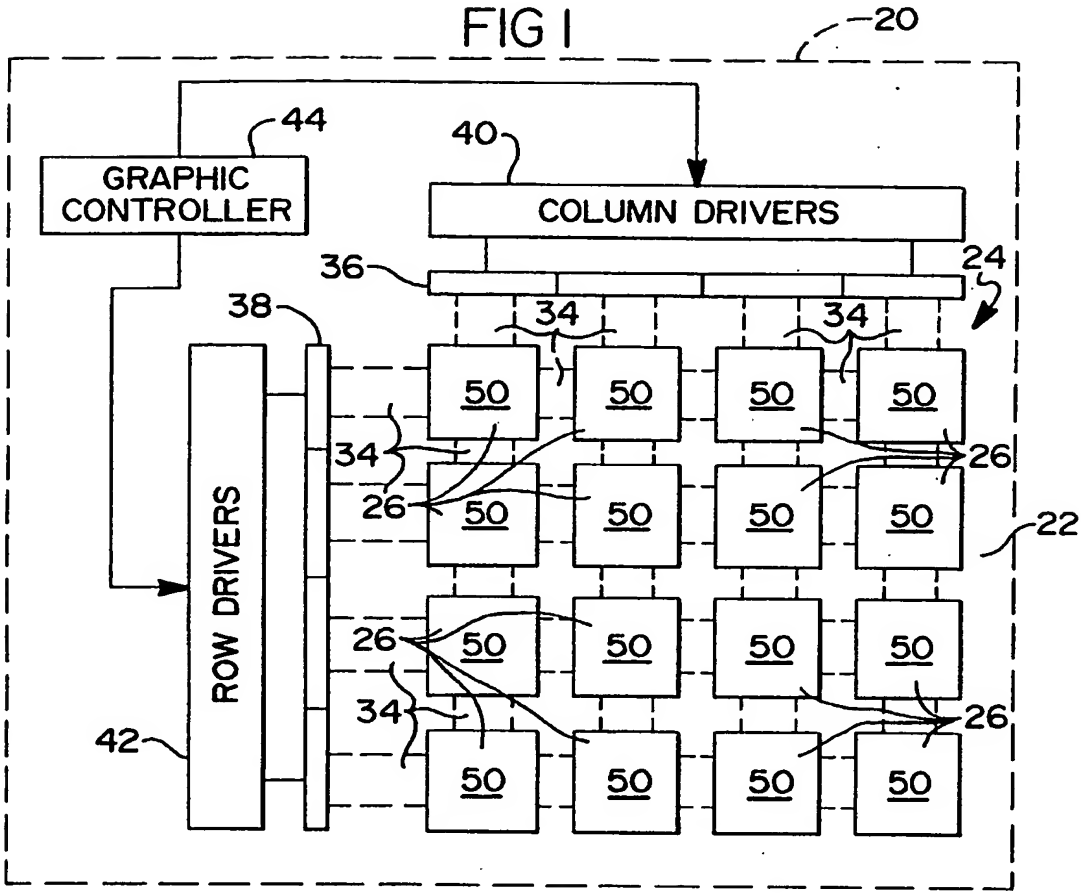
14. The interactive keyset of claim 12, further characterized by the web of flexible plastic comprising a single piece of flexible plastic mounting all the conductors and the mating contacts.

15. The interactive keyset of claim 12, further characterized by the web of flexible plastic comprising a separate strip including the mating contacts for interconnecting all keys in each row and a separate strip including contacts for interconnecting all keys in each column.

16. The interactive keyset of claim 13, further characterized by each key including a plurality of locating pins and the plastic web including a plurality of mating holes receivable on the pins to accurately locate and engage the contacts with the mating contacts.

17. The interactive keyset of claim 16, further characterized by pressure means for pressing the contacts and mating contacts together.

FIG 1



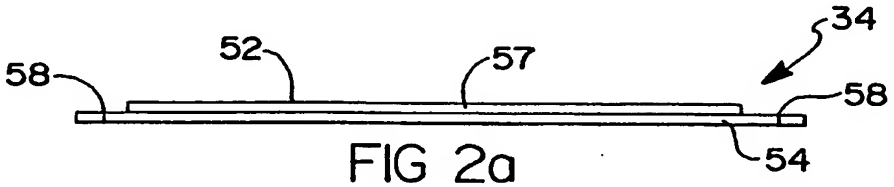


FIG 2a

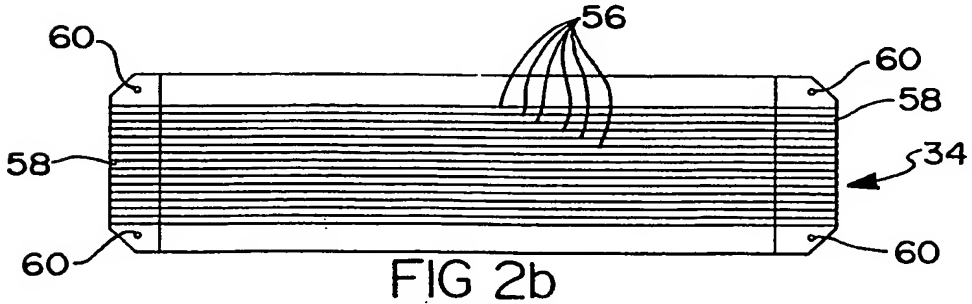
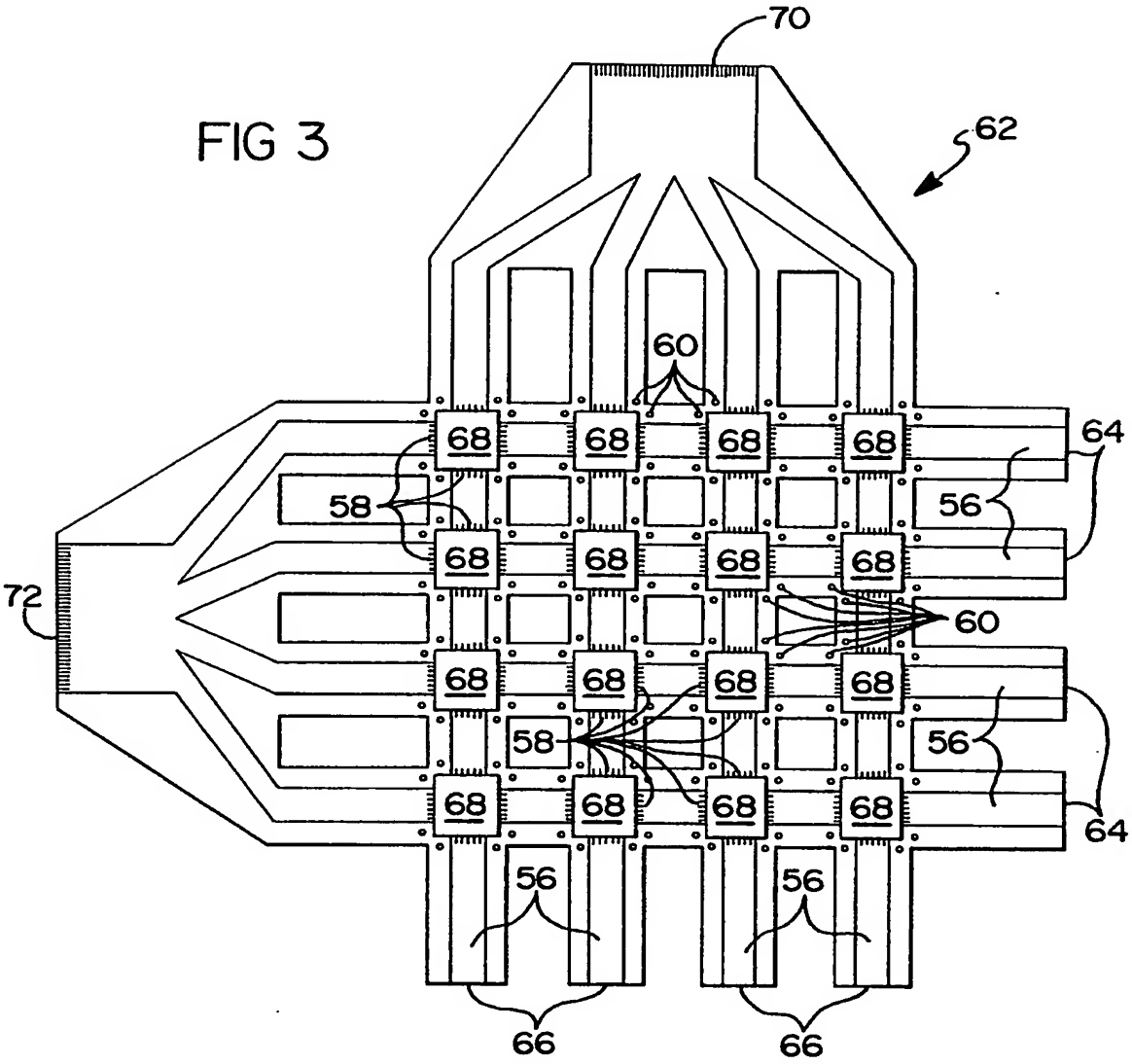


FIG 2b

FIG 3



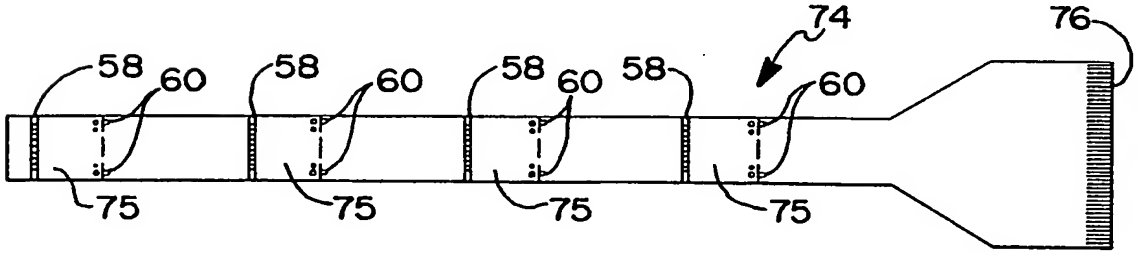


FIG 4a

FIG 4b

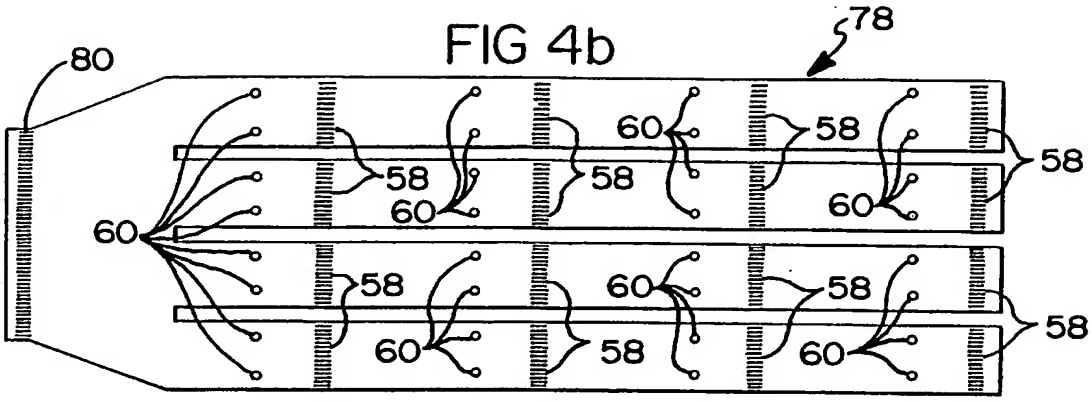


FIG 5a

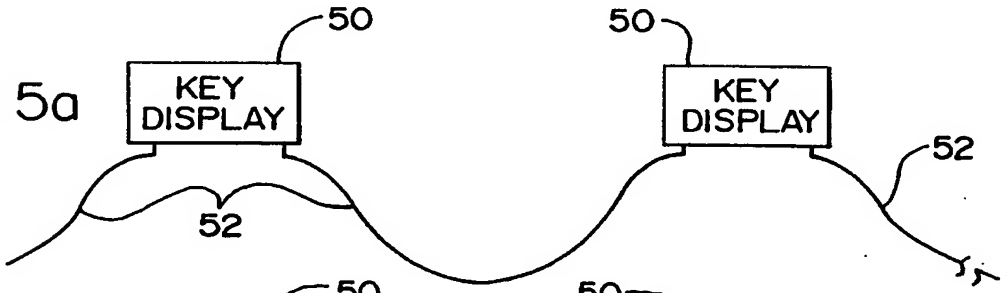


FIG 5b

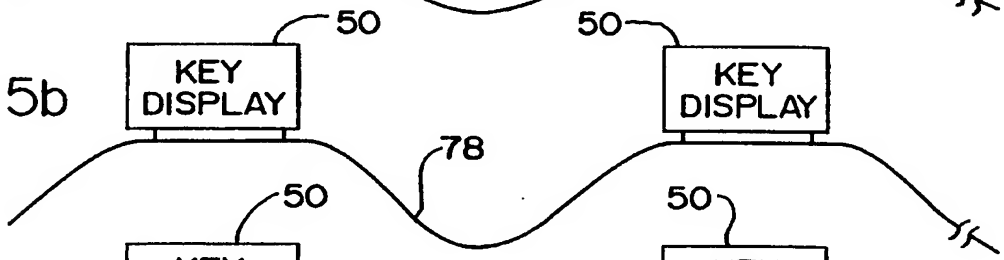


FIG 5c

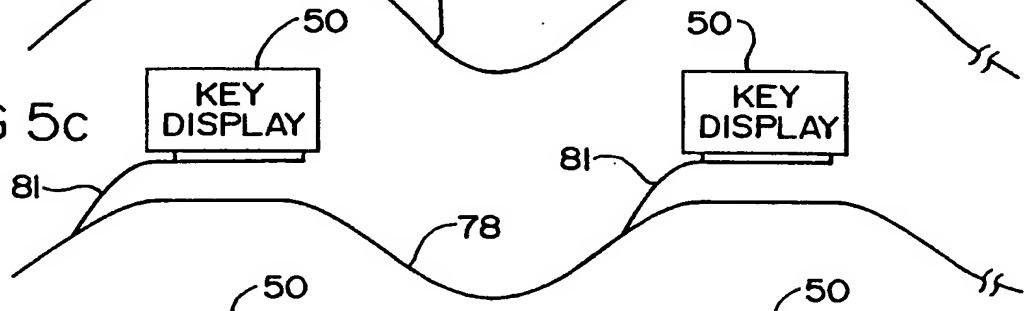


FIG 5d

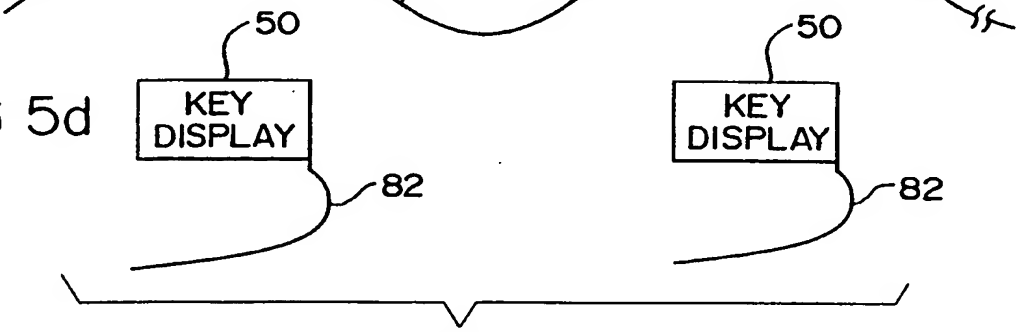


FIG 6

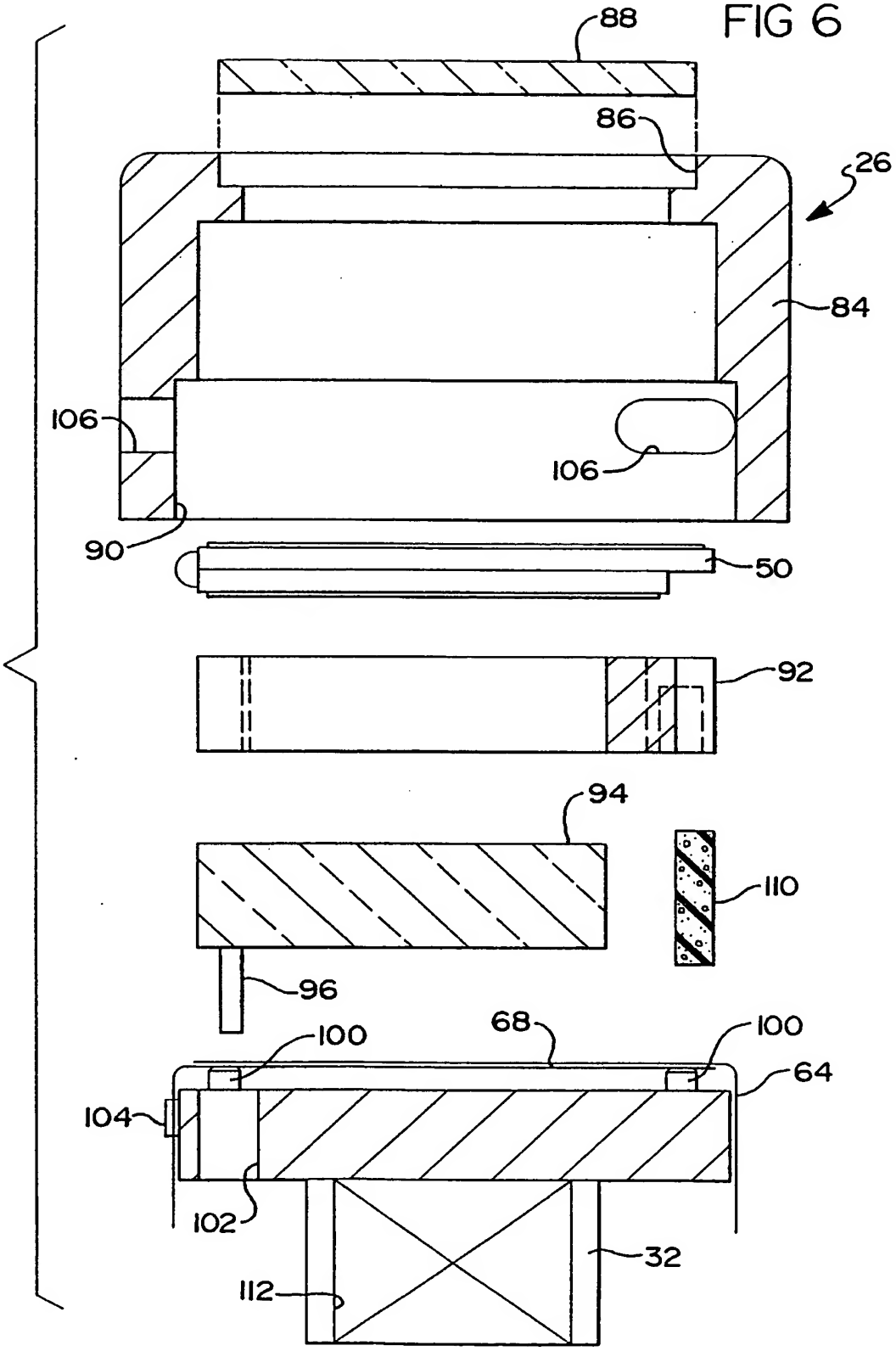
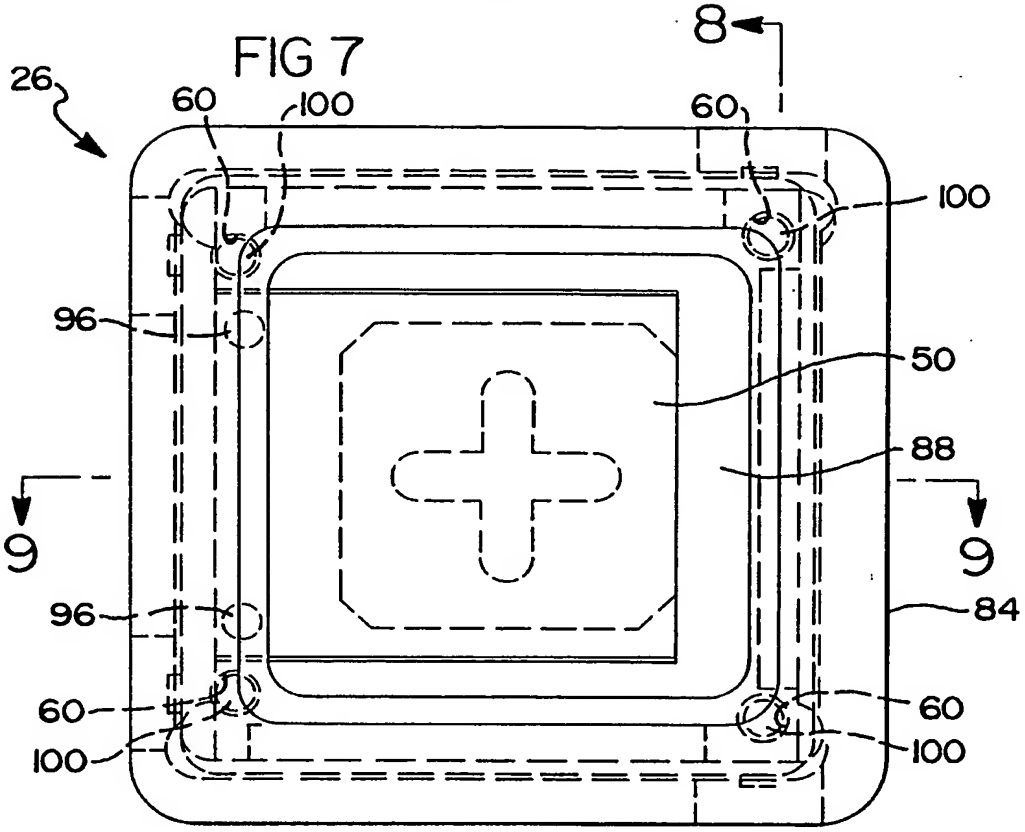


FIG 7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96
50
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9
96
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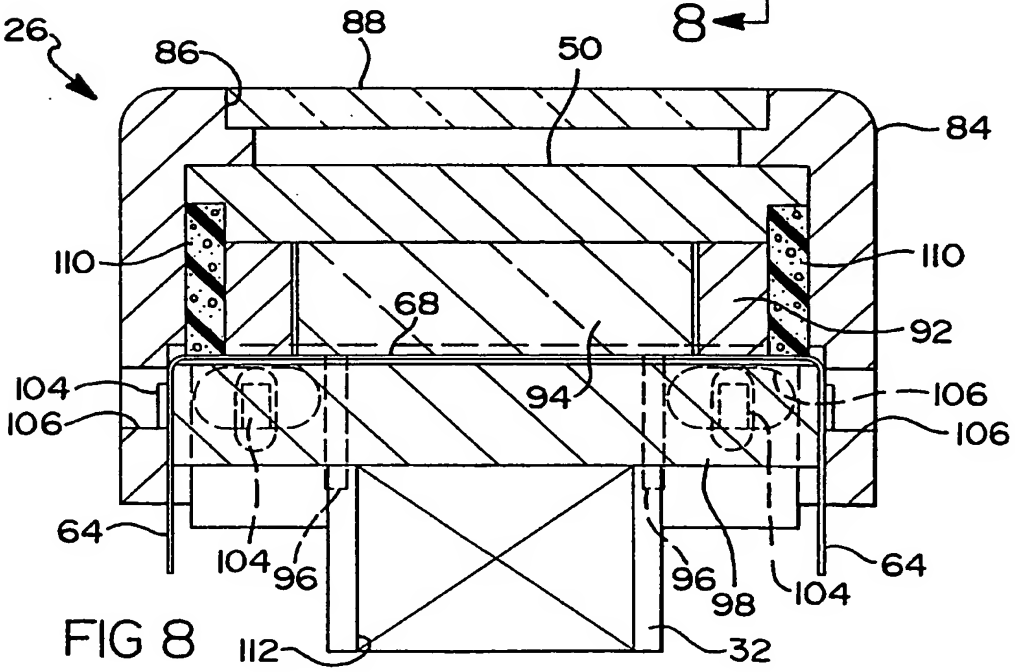
60
100
100
8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112
32

FIG 8

FIG 9

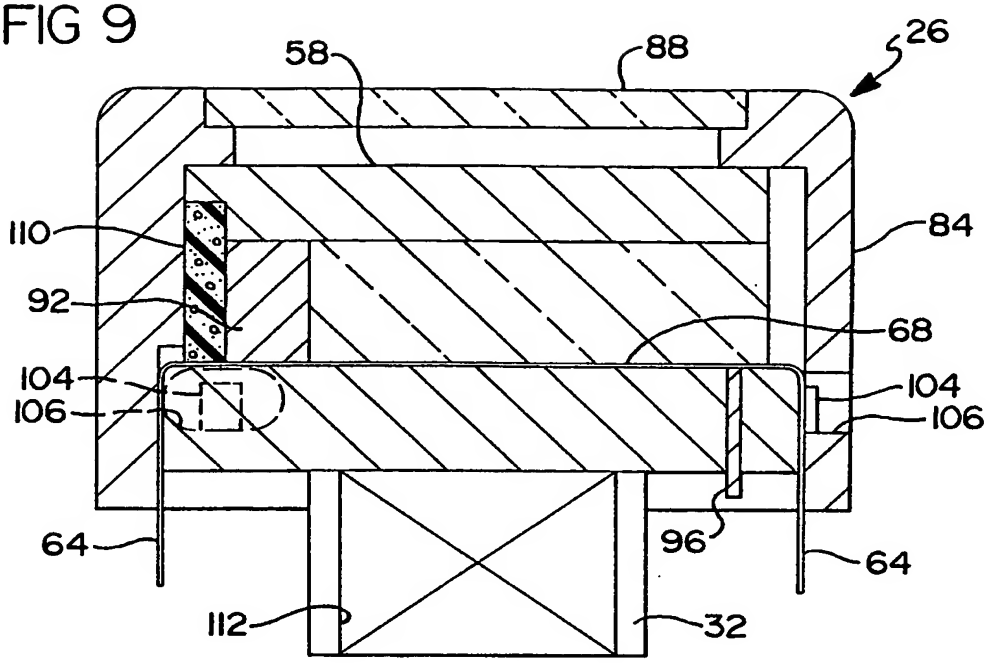
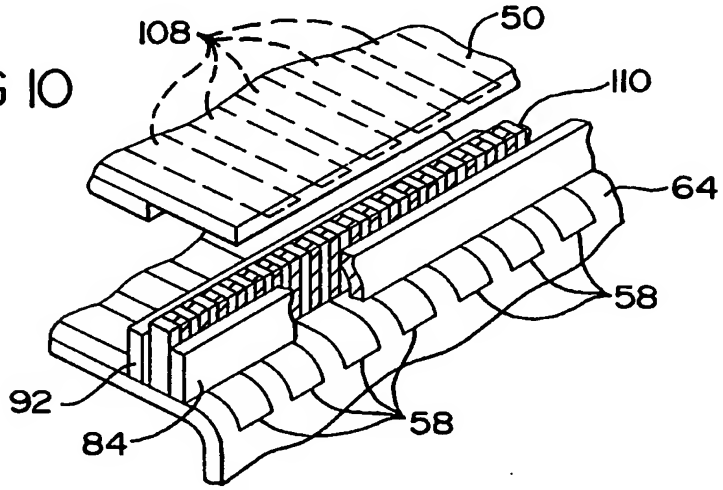


FIG 10



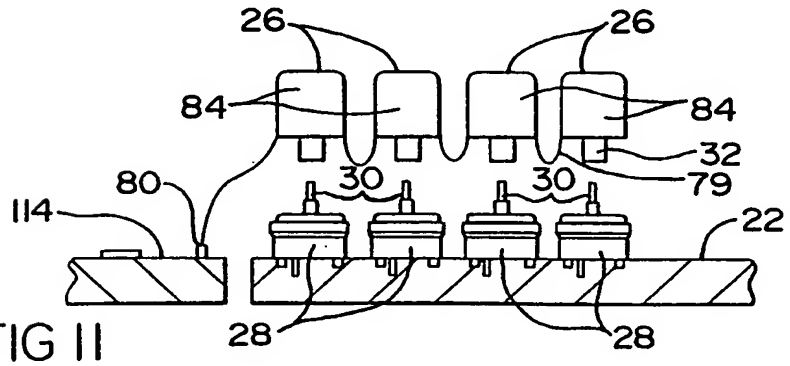


FIG 11

1	2	3	REDIAL
4	5	6	VOLUME
7	8	9	PHONE #
*	0	#	FEATURES

FIG 12a

FAMILY	CLIENTS	SUPPLIERS	DOCTORS
C CARDS	SPORT TICK.	THEATRES	RELATIVES
HOSPITALS	POLICE	FIRE	SHOPPING
SUPP. SERV.	CITY SERV.	STATE SERV.	CITY GOV.

FIG 12b

MAYOR	TAX A.	CITY COUN.	SANITATION
WATER DEPT.	SEWER	CITY ATTY.	POLICE
	TELEPHONE	ELECTRICITY	GAS
CABLE		OIL	INTERNATIONAL

FIG 12c

			
GB	FR	BE	CH
DE	RU	IT	MX
CZ	ES	AU	NZ

FIG 12d

CONF. CALL	CALL FORW.	REDIAL	
CALL WAIT.	VOICE MAIL	RETRV. MES.	
TRANSFER	LEAVE MES.	CALLER I.D.	
HOLD	CHANGE V.M.		RETURN

FIG 12e

INTERNATIONAL SEARCH REPORT

International application No.
PC[redacted]94/12494

A. CLASSIFICATION OF SUBJECT MATTER
IPC(5) :G06F 3/02; H01H 13/70; H03M 11/02
US CL :345/172; 341/23
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 345/168,170,171,172; 341/22,23,26; 364/709.12,709.14,709.15; 200/5A

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y --- A	EP, A, 0 221 698 (DEMONTE) 13 May 1987; page 2, col. 2, lines 34-37; page 3, col. 1, lines 39-55; page 3, col. 2, lines 33-39; page 4, col. 2, lines 23-35; page 4, col. 2, line 50 to page 5, col. 1, line 4.	1,2,3,5,10,11 ---------- 4,6,7,8,9,12,13 ---------- 14,15,17
Y --- A	US, A, 5,150,118 (FINKLE ET AL.) 22 September 1992, col. 3, lines 31-33; col. 4, lines 15-22; col. 4, lines 40-44.	6,7,8,12,13,16 ---------- 14,15,17

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 01 FEBRUARY 1995	Date of mailing of the international search report 20 MAR 1995
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer STEVEN J. SARAS Telephone No. (703) 305-4718

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/[redacted]/12494

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	IBM Technical Disclosure Bulletin, Volume 21, No. 4, issued September 1978, I. Jones, "Programmable Keytop Employing Electrochromic Display", pages 1671-1672, see entire document.	4
Y	IBM Technical Disclosure Bulletin, Volume 23, No. 10, issued March 1981, H. D. Maxey, "Optically Powered And Controlled Electronically Alterable Key Labeling", pages 4611-4613, see entire document.	9